

## Annotated Checklist of Some Fungivorous Beetles (Coleoptera: Anamorphidae, Biphyllidae, Derodontidae, Endomychidae, Erotylidae, and Tetratomidae) of the George Washington Memorial Parkway

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### ABSTRACT

Seven collection methods were utilized at a national park site in northern Virginia to capture fungivorous beetles in the families Anamorphidae, Biphyllidae, Derodontidae, Endomychidae, Erotylidae, and Tetratomidae. Forty species and one subspecies were documented, including five new state records (*Hallomenus scapularis* Melsheimer, *Microsternus ulkei* [Crotch], *Triplax frontalis* Horn, *Tritoma erythrocephala* Lacordaire, and *Tritoma mimetica* [Crotch]). More than half of the Commonwealth's expected fauna was documented from the park. Malaise traps were the most productive capture method. Periods of adult activity, based on dates of capture, are given for each species. Relative abundance is noted for each species based on the number of captures.

**Keywords:** Arlington County, Fairfax County, fungus beetles, national park, new state records, Virginia.

### INTRODUCTION

Fungi and Coleoptera are among the most diverse heterotrophic organisms in the world with an equally diverse array of commensal and mutualistic fungus-beetle relations as well as combative interactions including entomopathogenic fungi (Kukor & Martin, 1987) and fungivorous beetles (Schigel, 2012). Fungivory is characteristic of many families of Coleoptera. The fungal mycelia are most frequently consumed by beetles together with the woody substrata (Schigel, 2012); however, fruit bodies and spores are also consumed (Schigel, 2008). Fungivorous beetles are not always easy to find in nature, and collecting them requires an arsenal of methods for efficient documentation (Schigel, 2008). This study utilized seven collection methods to assess the fauna of six fungivorous beetle families from a national park site in northern Virginia.

### STUDY SITES

The study sites include lands managed by the National Park Service as units of the George Washington Memorial Parkway (GWMP) in Virginia (Fairfax and

Arlington counties). Park sites that received inventory effort included: in Fairfax County, Dyke Marsh Wildlife Preserve, Fort Marcy, Great Falls Park, Little Hunting Creek, and Turkey Run Park, and in Arlington County, Arlington Woods (at Arlington House). This area covers approximately 927 ha. A map of these sites is provided in Steury (2011). Great Falls and Turkey Run parks and Fort Marcy fall within the Piedmont physiographic province while all other collection sites are on the Coastal Plain. Most sites are situated along the shore of the Potomac River, and Great Falls and Turkey Run Parks border the Potomac River Gorge, an area with a long history of biodiversity studies (Brown, 2008). Most of the study sites are dominated by maturing, second growth, primarily upland, deciduous woodlands with a band of floodplain forest along the Potomac River. More open, herbaceous dominated habitats can be found along the river shores and in the marsh habitats at Dyke Marsh. The vascular flora of the GWMP is diverse, with more than 1,313 taxa recorded, 1,020 from Great Falls Park alone (Steury et al., 2008; Steury, 2011).

### MATERIALS AND METHODS

Specimens were collected during a 19-year period

(1998-2017) using a variety of sporadic survey efforts targeting arthropods, including: Malaise traps, Lindgren funnels, blacklight (UV) bucket traps, blacklight shone on sheets, leaf litter samples processed in Berlese funnels, beating sheets, and hand picking (including examination of fungi in the field). Six Townes style Malaise traps (Townes, 1962) were set at Dyke Marsh, April 1998-December 1999, three each at Great Falls and Turkey Run parks (March 2006-November 2009), and four at Little Hunting Creek (March-November 2017). Traps at Dyke Marsh were set each year in the same locations in open, tidal, freshwater marsh dominated by *Typha angustifolia* L., floodplain forest dominated by red and silver maple (*Acer rubrum* L. and *A. saccharinum* L.) and tulip poplar (*Liriodendron tulipifera* L.), and at the marsh/forest ecotone. In Great Falls Park, a trap was set in each of three habitats: quarry site (dry, upland, mixed deciduous/coniferous forest), swamp (dominated by red maple), and floodplain forest (dominated by oaks [*Quercus* sp.], and tulip poplar). In Turkey Run Park, one trap was set in upland forest dominated by oaks and tulip poplar and two traps in floodplain forest along the Potomac River (dominated by oaks, basswood [*Tilia americana* L.], and sycamore [*Platanus occidentalis* L.]). At Little Hunting Creek, four traps were set in upland forest dominated by an ericaceous understory and a canopy of oaks, hickory (*Carya* sp.), American beech (*Fagus grandifolia* Ehrh.), and some Virginia pine (*Pinus virginiana* Mill.).

Additional collections of species from these six families of beetles were also made by sporadically using other collecting methods, including running pitfall traps set at Dyke Marsh (five years) and at Little Hunting Creek and Great Falls and Turkey Run parks (three years); Lindgren funnel and blacklight (UV) bucket traps set at Dyke Marsh, Great Falls Park, Little Hunting Creek, and Turkey Run Park (two years); blacklight shone on sheets at Great Falls and Turkey Run parks (three years); leaf litter from Arlington Woods, Dyke Marsh, Fort Marcy, Great Falls Park, and Turkey Run Park, processed in Berlese funnels (two years); beating sheets (three years); and collecting by hand (including examination of fungi in the field) at all sites, over seven years. Locations, habitat descriptions, and collection methods are summarized in Table 1. Collectors included C. Acosta, E. Barrows, J. Brown, C. Davis, A. Evans, J. Fisher, S. Lingafelter, D. Mead, E. Oberg, M. Skvarla, D. Smith, W. Steiner, B. Steury, J. Swearingen, and C. Wirth. State record determinations are based on reviews of Boyle (1956), Ciegler (2014b), Downie & Arnett (1996), Evans (2008), Lawrence (1989), and Shockley et al. (1999). Specimens were determined by Arthur V. Evans or Brent W. Steury. Specimens were pinned, labeled, and deposited in the collections maintained at

the George Washington Memorial Parkway (GWMP), Turkey Run Park Headquarters in McLean, Virginia.

## RESULTS AND DISCUSSION

Forty species and one subspecies were documented from GWMP in six families of fungivorous beetles (Anamorphidae, Biphyllidae, Derodontidae, Endomychidae, Erotylidae, and Tetratomidae). This is more than half of the expected fauna of Virginia (see list of species for number of species expected in Virginia from each family), emphasizing the importance of parks as havens for biodiversity near urban areas. Management decisions to not remove, or chip, downed woody debris, and to leave standing, non-hazardous, dead trees has undoubtedly provided an abundance of substrates for fungal growth, and food and shelter for beetles that feed on these fungi. Recently, the amount of standing and downed dead wood in GWMP has greatly increased due to the death of large ash trees (*Fraxinus americana* L., *F. pennsylvanica* Marshall, and *F. profunda* [Bush] Bush) infected by emerald ash borer (*Agrilus planipennis* Fairmaire), a non-native buprestid beetle. Although this loss is detrimental to arthropods that feed exclusively on ash (Gandhi & Herms, 2010), it will undoubtedly increase habitat and food sources for fungi, and the beetles associated with them.

Five species (*Hallomenus scapularis*, *Microsternus ulkei*, *Triplax frontalis*, *Tritoma erythrocephala*, and *Tritoma mimetica*) are documented in the literature for the first time from Virginia. Thirty-four species and one subspecies documented from Great Falls and Turkey Run parks are recorded for the first time from the Potomac River Gorge (Brown, 2008). Only three species (*Triplax flavicollis*, *Tritoma biguttata biguttata*, and *Tritoma humeralis*) were found to be abundant within the study area. In comparison, the other 38 taxa were rarely encountered despite 19 years of survey effort. Great Falls Park was the most species-rich site with 28 species, followed by Turkey Run Park (27 taxa), Little Hunting Creek (14), and Dyke Marsh (12). Malaise traps were the most successful capture method (37 taxa), followed by hand picking (12), Berlese funnels (6), Lindgren funnels (4), and UV bucket traps (3).

## LIST OF SPECIES

The number of specimens in the collection at GWMP is indicated in parentheses after each taxon. Taxa too common for all specimens to be kept are listed as abundant. Sites, habitats, and collection methods are given following the abbreviations listed in Table 1. Other locations and habitats within sites are indicated when necessary. The periods of adult activity are based on

Table 1. Summary of locations, latitude and longitude, habitats sampled, and trap types used during this study. Additionally, all sites were sampled by hand picking, including examination of fungi in the field (hp) and beating sheets (bs).

Location	Latitude and Longitude	Habitats Sampled	Trap Types
<b>Arlington County</b>			
Arlington Woods (AW)	N 38.883, W -77.074	Upland, deciduous forest (uf)	Berlese funnels (bf)
<b>Fairfax County</b>			
Dyke Marsh Wildlife Preserve (DM)	N 38.772, W -77.050	Tidal, freshwater marsh (tm); floodplain, deciduous forest (ff); marsh/forest ecotone (ec)	Berlese funnels; blacklight (UV) bucket traps (uv); Lindgren funnels (lf); pitfall traps (pt); Townes style Malaise traps (mt)
Fort Marcy (FM)	N 38.937, W -77.125	Upland, deciduous forest	Berlese funnels
Great Falls Park (GF)	N 38.985, W -77.246	Upland, mixed deciduous/coniferous forest (qu); deciduous swamp (sf); floodplain, deciduous forest	Berlese funnels; blacklight shone on sheets (bl); blacklight bucket traps; Lindgren funnels; pitfall traps; Townes style Malaise traps
Little Hunting Creek (LH)	N 38.717, W -77.078	Upland, deciduous forest with some pine (dp)	Blacklight bucket traps; Lindgren funnels; pitfall traps; Townes style Malaise traps
Turkey Run Park (TR)	N 38.965, W -77.156	Upland, deciduous forest; floodplain, deciduous forest	Berlese funnels; blacklight shone on sheets; blacklight bucket traps; Lindgren funnels; pitfall traps; Townes style Malaise traps

dates when live individuals have been documented in the park. Dates separated by a hyphen indicate that the taxon was documented on at least one day during each month within this continuum of months, whereas dates separated by a comma represent individual observation dates. For traps set over multiple weeks, the first day of the set is used as the earliest date and the last day of the set as the latest date. Taxa newly recorded for the Potomac River Gorge are marked by an asterisk.

#### Biphyllidae (False Skin Beetles)

Two species occur in eastern North America, both of which have been documented in Virginia. One of these species was found in GWMP. These beetles feed on fungal spores (Downie & Arnett, 1996).

*Diplocoelus brunneus* LeConte – (1); LH dp; 19 Sep-10 Oct; mt.

#### Anamorphidae (False Handsome Fungus Beetles)

This family was split from Endomychidae by Robertson et al. (2015). Two species have been documented from Virginia (Shockley et al., 1999), one of which was found in GWMP. Species in this family are generally quite small, some less than 1 mm, and thus easily overlooked.

\**Clemmus minor* (Crotch) – (1); TR ff; 18 Aug-4 Sep; mt.

#### Derodontidae (Tooth-necked Fungus Beetles)

Four species in two genera are expected in Virginia, one of which, *Laricobius nigrinus* Fender, has been introduced as a biological control agent for the hemlock woolly adelgid (*Adelges tsugae* [Annand]). *Laricobius rubidus* LeConte reaches its southern known limit in Washington, DC, but has not yet been recorded from Virginia (Lawrence, 1989). *Laricobius* are not fungivores, but instead feed on adelgids (Hemiptera:

Adelgidae) that feed on conifers. *Derodontus* feed on fruiting bodies of Basidiomycotic fungi. Two species are documented from GWMP.

\**Derodontus esotericus* Lawrence – (26); DM ec, GF sf, TR ff; 22 May-1 Jul, 19 Sep-5 Dec; mt.

\**Derodontus maculatus* (Melsheimer) (Fig. 1) – (4); GF sf, TR ff; 22 Oct-17 Nov; mt. Always captured in association with *D. esotericus*.

#### Endomychidae (Handsome Fungus Beetles)

Ten species have been documented in Virginia (Shockley et al., 1999), of which seven are recorded from GWMP. *Holoparamesus* contains five species, three of which are cosmopolitan, but none has been found in Virginia. One of these, *H. caularum* Aubé, has been documented only in the eastern United States from Florida and Michigan. The other two have been recorded near Virginia, *H. depressus* Curtis (Georgia and New York) and *H. singularis* (Beck) (New York). A fourth species, *H. ragusae* Reitter, occurs in Pennsylvania (Shockley et al., 1999).

\**Aphorista vittata* (Fabricius) – (3); GF sf and rocky outcrop above Sandy Landing, TR Leiter Mansion ruins; 15 Apr-10 May, 16-30 Jul; bf, hp, mt.

\**Endomychus biguttatus* Say – (16); DM ec, GF sf, TR uf and ff; 1 May-21 Oct, 15 Dec; hp (under bark of large fallen *Liriodendron tulipifera* L. [Magnoliales: Magnoliaceae], on fungus), mt.

\**Mycetina perpulchra* (Newman) – (7); GF sf, LH dp, TR ff; 23 Apr-26 Jul; mt.

\**Phymaphora pulchella* Newman – (2); GF sf; 18 Mar-30 Apr; mt.

\**Rhanidea unicolor* (Ziegler) – (8); AW uf, DM ec, GF qu and Difficult Run, LH dp; 10 Apr-18 May; bf, lf, pf, mt.

\**Stenotarsus blatchleyi* Walton – (12); DM ff, GF sf, LH dp, TR ff; 19 Jun-14 Aug; mt.

This species was not included for the northeastern United States by Downie & Arnett (1996.). It reaches its northern extreme in Virginia and has not been documented in North Carolina (Shockley et al., 1999).



Fig. 1. *Derodontus maculatus* (Melsheimer); Collection data: Virginia, Fairfax Co., Great Falls Park, swamp, Malaise trap, 22 October - 11 November 2008, B. Steury & D. Smith. Top, dorsal habitus. Bottom, close-up of the head and pronotum of the same specimen.

*Stenotarsus hispidus* (Herbst) – (1); LH dp; 20-30 Jun; mt.



Erotylidae (Pleasing Fungus Beetles)

There are 57 potential species in South Carolina (Ciegler, 2014a). Downie & Arnett (1996) report 36 species in northeastern North America and Evans (2014) reports 40 in the eastern United States. Twenty species and one subspecies have been documented from GWMP.

*Acropteroxys gracilis* (Newman) – (3); DM tm and ec; 28 May-8 Aug; mt.

\**Ischyrus quadripunctatus* (Olivier) – (19); GF ff, TR ff and uf; 10 Apr-4 Sep; mt, uv.

*Languria angustata* (Beauvois) – (3); DM tm; 16 Jun-8 Aug; mt.

*Languria mozardi* Latreille – (1); FM uf; 15 Apr; bf.

*Loberus impressus* LeConte – (8); DM tm; 11 Apr-1 Aug; mt.

\**Megalodacne fasciata* (Fabricius) – (2); TR uf, LH dp; 11 Jun-30 Jul; hp (shelf fungus on stump), mt.

\**Megalodacne heros* (Say) – (4); GF uf; 24 Jun-6 Jul; hp (on fungus), uv.

\**Microsternus ulkei* (Crotch) – (2); TR ff, GF sf; 10 Apr-21 Jun; mt. **NEW STATE RECORD.**

This species has a narrow range in North America extending from Illinois (Goodrich, 1994) and Tennessee eastward to Pennsylvania and North Carolina (Downie & Arnett, 1996). It appears to have a relict distribution, being the only Nearctic representative of a widely distributed genus. It is not common where it occurs (Boyle, 1956). It has been documented on shelf fungi in the family Hymenochaetacea (Goodrich, 1994).

\**Toramus pulchellus* (LeConte) – (8); AW uf, GF ff; 15 Apr, 23 Jun-6 Aug; bf, bl, uv.

\**Triplax festiva* Lacordaire – (5); AW uf, LH dp, GF sf; Apr 10-30, 3 Jun-15 Oct; bf, lf, mt.

\**Triplax flavicollis* Lacordaire – (abundant); DM ec, GF qu, TR uf; 17 May-17 Nov; hp (under bark and on fungus), mt.

A Malaise trap set in floodplain forest in Turkey Run Park from 22 October-17 November 2008 contained 63 *T. flavicollis* and 2 *T. thoracica*.

\**Triplax frontalis* Horn – (3); AW uf, GF qu; 10-30 Apr; bf, mt. **NEW STATE RECORD.**

This beetle occurs from Nebraska and Texas eastward to Georgia and Pennsylvania (Boyle, 1956; Downie & Arnett, 1996).

\**Triplax thoracica* (Say) – (5); DM ec, TR ff; 7-21 Jul, 5 Oct-17 Nov; mt.

\**Tritoma biguttata biguttata* (Say) – (abundant); LH dp, GF qu, TR ff; 21 May-10 Oct; hp (in gills of yellowish-orange *Russula* sp. [Russulales: Russulaceae; near *R. ochroleuroides* Kauffm]), mt.

\**Tritoma biguttata affinis* Lacordaire – (8); LH dp, TR ff; 5 Aug-10 Oct; mt.

This subspecies is reported by Evans (2014) as not occurring on the East Coast north of southern North Carolina, however Downie & Arnett (1996) list records from as far north as Pennsylvania.

\**Tritoma erythrocephala* Lacordaire – (2); LH dp, TR ff; 7-21 Jun, 19 Sep-10 Oct; mt. **NEW STATE RECORD.**

This beetle was expected in Virginia because it was documented previously in many states from Texas and Kansas eastward to New York and Florida (Downie & Arnett, 1996).

\**Tritoma humeralis* Fabricius – (abundant); DM ff, LH dp, GF sf, TR ff; 21 May-10 Oct; pf, mt.

A Malaise trap set from 19 September-10 October 2017 at Little Hunting Creek contained 88 *T. humeralis*, 34 *T. b. biguttata*, 7 *T. b. affinis*, and 1 *T. erythrocephala*.

\**Tritoma mimetica* (Crotch) – (4); GF ff and qu, TR ff; 23 May-30 Jun; mt. **NEW STATE RECORD.**

Virginia is well within the range of this species, which has been documented from Texas and Kansas eastward to Quebec and Florida (Downie & Arnett, 1996).

\**Tritoma pulchra* Say – (6); GF ff, TR ff; 1 May-26 Jul; mt.

\**Tritoma sanguinipennis* (Say) – (10); LH dp, GF sf and qu, TR ff; 10 Apr -30 Jul; mt.

\**Tritoma unicolor* Say – (4); GF sf; 19-30 Jun; mt.

## Tetratomidae (Polypore Fungus Beetles)

This family was split from the Melandryidae (false darkling beetles) by Nikitsky (1998). Evans (2014) reported 17 species in the eastern United States and 12 species are reported for South Carolina (Ciegler, 2014b). Nine species have been documented at GWMP.

\**Eustrophopsis bicolor* (Fabricius) – (4); DM ec and ff, TR ff, GF ff; 19-28 Apr, 30 Jun-13 Jul, 11-27 Sep, 15 Dec; hp (under bark of dead standing *Carya tomentosa* [Lam.] Nutt) (Fagales: Juglandaceae), mt.

\**Eustrophus tomentosus* Say – (4); GF riverside prairie and uf, TR uf; 15 Jan, 14 Apr; hp (under bark and under loose bark of dead standing *Quercus coccinea* Münchh. [Fagales: Fagaceae]).

\**Hallomenus scapularis* Melsheimer (Figs. 2-3) – (4); TR uf; 5 Sep-21 Oct; mt. **NEW STATE RECORD.**

Pale form (perhaps subteneral) *Hallomenus scapularis* (Fig. 2) is very similar to descriptions of *H. debilis* LeConte. These two species overlap in range



Fig. 2. *Hallomenus scapularis* Melsheimer (pale form); Collection data: Virginia, Fairfax Co., Turkey Run Park, gulch, Malaise trap, 5 September-21 October 2009, B. Steury & D. Smith. Length 4.0 mm. The slightly paler humeral angles can be seen even in pale form specimens.



Fig. 3. *Hallomenus scapularis* Melsheimer (typical form). Same collection data as Fig. 2.

and body length. They are separated in keys (Downie & Arnett, 1996; Ciegler, 2014b) based on dorsal coloration rather than anatomical features. The two can reportedly be separated by the extent of the basal punctures on the pronotum; “small depressions” in *H. debilis* and “large, deep impressions” in *H. scapularis* (Ciegler, 2014b). These four specimens were captured in the same Malaise trap, but only one was of the pale form.

\**Holostrophus bifasciatus* (Say) – (16); DM ec, LH dp, GF sf, TR uf; 10 Apr-20 Jul; pf, mt.

\**Penthe obliquata* (Fabricius) – (5); GF sf, TR ff; 16 Jun-17 Aug; hp (under bark), lf, mt.

\**Penthe pimelia* (Fabricius) – (7); LH dp, GF sf and uf, TR ff and uf; 10 Apr-24 Aug; hp, lf, pf, mt.

\**Pisenus humeralis* (Kirby) – (1); TR ff; 22 Oct-17 Nov; mt.

\**Synstrophus repandus* (Horn) – (15); GF riverside prairie, TR uf and ff; 14 Apr, 24 Jun-21 Jul; bs, hp (under bark), mt.

Two specimens are of the brown form, the remainder are of the more typical black form.

\**Tetratoma tessellata* (Melsheimer) – (1); GF ff; 21 May-18 Jun; mt.

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